

LXIII.—On the Genus *Notykus* (Mich.), and on a new Species of that Genus. By FRANK E. BEDDARD, M.A., D.Sc., F.R.S.

I RECEIVED lately through the kindness of Mr. Loveridge some species of earthworms collected by him in the Tanganyika district of Eastern Tropical Africa, which were forwarded to me at the Natural History Museum. I have to thank Dr. Baylis for forwarding them on to me at the Zoological Society. Of these worms there were altogether four specimens, of which I left one entirely out of consideration owing to its very softened condition. Of the others one was in a very fair state of preservation for anatomical study, the other two not so good, but still they could be satisfactorily studied. I refer to these three specimens as A, B, and C. They are thus lettered in the collection of the Natural History Museum, to which I have returned them for reference by others. Specimens A and B were collected on a footpath at Chanzuru, near to Kilossa; specimen C at Kilossa. They all seem to belong to one species, in spite of certain apparent external differences, to which I shall refer in the following description. For reasons which will be also apparent in that description, I regard these Eudrilids as a new species of *Notykus*, which I name *Notykus kilossensis*.

The genus *Notykus* has been described by Michaelsen, and not, as it would appear, examined by any other zoologist subsequently to his two papers*. The characters of the genus and of the single species referable thereto are summed up in the same naturalist's comprehensive work upon the Oligochæta †.

It is not, of course, unnoticed by myself ‡.

Specimen A is about 90 mm. long, with a diameter of 4–5 mm. The second specimen is apparently of much the same size, but has lost hind end, and both, therefore, are quite approximate to *Notykus emini*. Michaelsen, however, states that the setæ of his species are delicate and not large. This is not the case with my species, of which all specimens

* "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar und dem gegenüberliegenden Festlande gesammelten Terricolen," JB. Hamb. wiss. Anst. ix., Hamburg, 1891; "Neue und wenig bekannte afrikanische Terricolen," JB. Hamb. wiss. Anst. Beiheft 2, xiv., Hamb. 1897.

† "Oligochæta," in 'Das Tierreich,' Berlin, 1900, p. 396.

‡ 'A Monograph of the Order of Oligochæta,' Oxford, 1895, p. 594 et passim.

show certainly very small setæ anteriorly, but much larger ones and stiffly projecting posteriorly and, indeed, for the greater part of the body. This may be claimed, as I think, as a distinct mark of specific distinctness of the two species. So also is the presence of dorsal pores—a rare occurrence, as is known, in Eudrilids. In his earlier paper Michaelsen remarks that these pores were not seen; but does not allude to them in his later memoir upon *Notykus*. They are quite distinct in my species, but only after the clitellum, and are plainer perhaps in specimen A than in specimens B and C.

In agreement with the characters of *N. emini*, my species has a *prostomium* which is extended for a short distance on to the first segment.

The clitellum was developed only in A and C; as I judge from an internal inspection it occupies segments 15, 16, and is developed completely all round the body. These facts are as in *N. emini*.

The *spermathecal pore* and associated pores are on segment 13 (and perhaps 14, see later), and the first examination of the worms from external characters only would perhaps lead to the separation of them into two species. In A—and specimen C hardly differs—the aperture is elongated from right to left, and measures about 1.5 mm. in length; its margins are rather tumid and furrowed at right angles to the long axis of the actual aperture. The aperture when viewed carefully shows that it is divided internally into two pores with a flat dividing area. But these lie within the single area and are thus sunk below the surface of the body. In specimen B, however, the whole arrangement of the various orifices is so different that it is, at first, difficult to refer the two worms to the same species. I believe, however, that they are thus united, for reasons which will appear presently. Here (in specimen B, which, it is to be remembered, is less mature, having no clitellum and also with the internal organs of sex less developed) there is a conspicuous crescentic spermathecal pore with quite unswollen lips, and with the convexity of the crescent directed forwards; behind this are two large orifices nearly meeting in the middle line, with the actual lumen blocked by folds of membrane suggestive of a prolapsus. The three apertures lie in an area which is about 3 mm. across and is furrowed, the lines running longitudinally.

It is clear on *a priori* grounds that the retraction of the two large pores of specimen B would produce a state of affairs such as is to be noted in specimens A and C.

This matter will be considered further in relation to the various organs which are connected with the three orifices just described.

The *male pore* of this species is on segment 17 and also in the middle line of the ventral surface. In specimen A it is very small and measures about .5 mm., and is surrounded by radiately arranged folds of the skin. In B the equivalent aperture is much larger, and measures 2 mm. from side to side. Moreover, in this particular worm the front margin of the longitudinal orifice has two cushion-like projections and the posterior margin one such projection. Here, again, the differences in size etc. might be explained by a contraction of the body pulling in the external aperture. It will be noted anyhow that the two apertures, male and female, of each of the two specimens correspond in this particular—*i. e.*, both are retracted in the one and both expanded outwards in the other specimen.

The external characters are to my mind alone quite sufficient to distinguish the present species from *Notykus emini*. The larger setæ and dorsal pores of the former contrast with the converse state of affairs shown in *N. emini*. Moreover, Michaelsen speaks of the orifices on either side of the spermathecal pore as "kleine spaltförmige Oeffnung," and as "etwas nach vorn gerückt . . . schlitzförmigen Oeffnungen," which does not tally with the wide circular orifices in my specimen, which lie distinctly behind the spermathecal crescent-shaped opening. That they belong, however, to the same genus is clearly shown by the peculiar penial setæ figured by Michaelsen, which in both my specimens have the end bent at right angles and covered with low spines, presenting, as Michaelsen points out, a resemblance to a file. It hardly seems likely that precisely the same modification of the penial setæ would occur in two genera. The internal characters, moreover, furnish further proof of the generic identity of specimens; but enable me to add something to what is known of the genus *Notykus*, and possibly present further differences between the two species.

In considering the value of these apparent differences, the greater maturity of specimens A and C must be borne in mind. Thus, in these worms the interior of segment 12 was filled with masses of sperm on both sides of the intestine, quite blocking the cœlomic cavity of that segment. Of these I found no trace in specimen B, in which, moreover, the sperm-sacs of segment 12 were much less developed. These features are obviously due to different maturity. Furthermore, the male terminal apparatus differed slightly

in the two. In A the masses of muscles forming a hollow sheath for the single penial seta were thicker and more numerous than in the younger individual. In both, however, they reached to the converging ends of the separate prostates, and were thus more conspicuous than in the individual figured by Michaelsen in the first of his two memoirs dealing with this genus. This, again, may be fairly ascribed to greater maturity in specimen A. In these characters, therefore, there are no generic differences from Michaelsen's specimens. I have also identified the peculiar median body thought at first by Michaelsen to be a median single ovary. I have no suggestions to make as to the nature of this body, except, perhaps, that it may correspond to the glandular bodies attached to the end of the spermathecal sac in the genus *Eudriloides*.

One internal character, however, fairly obviously cannot be referred to differing maturity—that is, the conditions of the intersegmental septa as to their relative thickness. I have examined these in all of my examples, with particular success in the case of specimen C, which was divided longitudinally into two halves before further dissection. This enabled an accurate picture of the septa to be seen. In his earlier paper on *Notykus emini*, Michaelsen states that septa 5/6–9/10 are thick septa, but in the later paper that the thickened septa are those lying between 5/6 and 11/12. Of these, he adds, the middle ones are the most thickened. There is an obvious discrepancy here. In his great work upon the Oligochæta, in which the facts are presumably revised, the thick septa are placed between 6/7 and 10/11, 5/6 and 11/12 being feebly thickened. In the example of *Notykus kilossensis*, which I bisected longitudinally, the first clearly marked septum lay just behind the gizzard, and thus separated segments 5/6. Thereafter four septa, of which the last two were thicker than those in front, separated segments 6/7–9/10. Septum 10/11 was a delicate septum pushed forward by the mass of sperm collected in segment 11, and might easily be missed owing to its lying for the most part in contact with the septum in front. I shall again refer to the septa in dealing with the spermathecal sac; but, in the meantime, I would point out that there would seem to be a specific difference in the arrangement of these so far back as segment 11. It may be also that the first example of *Notykus emini* described by Michaelsen is different from those subsequently examined, and is identical with my species described here.

The organs connected with reproduction, in addition to the

penial setæ described above, also tend to prove generic identity, though differing in detail (particularly the spermathecal sac). There is in the present species clearly but one pair of sperm-duct funnels, which lie in segment 11, and one pair of sperm-sacs, which are in the following segment.

Spermathecal Sac.—The general characters of this sac agree with those described by Michaelsen for *Notykus emini*; but there are certain details which require emphasis. I have studied these in all three specimens: in two by dissection from above—by cutting through the body-wall along the dorsal median line; in the third (C) by dividing the head-end of the body longitudinally and examining the sac in a lateral view. The latter allowed of a complete lateral external view, as the whole of the spermathecal sac was left in the right half of the body after the bisection.

In B, the immature example, the sac is divisible into three regions: in the middle of a muscular region presenting quite the appearance of a gizzard, which narrowed abruptly posteriorly to form a narrower tubular soft-walled sac ending behind in a slightly dilated extremity; anteriorly the muscular sac became a soft region rather flattened dorso-ventrally, which bent down at right angles to open on to the exterior by the narrow crescent-shaped external orifice, already described. When cut across, the gizzard-shaped median region was seen to be very thick-walled, and its muscular fibres gave to it a nacreous glitter common to such structures.

Firmly attached to the terminal region of the spermathecal sac and one on each side lay two muscular bodies, spherical to rather more oval in form, which have muscular walls. These are clearly the "Nebentaschen" of Dr. Michaelsen's descriptions. I did not detect in this specimen the delicate sac involving the spermathecal sac which is mentioned by the last-named author. But the egg-sacs were evident one on each side of the anterior end of the muscular part of the spermathecal sac. Some filmy membranes, which I could not map out, are doubtless the remains of the cœlomic chamber referred to by Michaelsen. These I refer to later.

The accessory pouches ("Nebentaschen"), closely attached to the outward end of the spermathecal sac, communicate, as it would appear, with the exterior through the paired orifices, described above as lying behind the spermathecal opening. I cannot recall any structure precisely similar to these among the *Oligochæta*. They might conceivably be the vestiges of sacs formerly containing copulatory setæ, such as do occur in the group. But this suggestion is

not at variance with the possibility that they are to be looked upon as evidence of the originally paired condition of the spermathecal sac, which is held to be the primitive state of affairs in the Eudrilidæ as in other families. In this case *Notykus* would bear the same relationship among the Pareudriliacea to the forms with paired (e. g., *Pareudrilus*) and unpaired (e. g., *Eudriloides*) orifices, as does the genus *Gardullaria* among the Eudrilacea*, to corresponding forms in that group.

On this hypothesis, the single median pore of the spermathecal sac would have to be a new formation, the original pores with their muscular ducts being converted to another function. That there is no necessary difficulty in this is shown by the case of *Polytoreutus multiporus*†, in which species that sac does form supplementary external pores.

In the two fully mature individuals the conditions are a little different. When examined from above (specimen A), the muscular part of the spermathecal sac is seen to be mostly covered over by a large muscular flap, one on each side; this presents the appearance of a thickened septum, and, as I point out later, may indeed be its derivative. A closer examination of this sheet of muscle shows that it is in reality a sac—empty, so that its two walls, dorsal and ventral, are in contact, thus giving to it the appearance of an empty coal-sack lying across the rounded mass, which it partly conceals. The two sacs seem to be continued anteriorly into a thin membrane covering the anterior portion of the spermathecal sac. When the two walls were divaricated by pushing a mounted needle between the two walls, the sac was seen to be prolonged downwards towards the ventral median line of the body. To the side of and behind these sacs lay on each side of the body the receptaculum ovarum. The position of this latter thus differs in the more mature individual. This may be produced, of course, by the growth of the flattened muscular sacs intervening.

In the bisected individual (C) the conditions can be further examined, and their relationships to other structures seen from the lateral point of view. Among other things, the exact number of segments occupied by the spermathecal sac can be detected. The anterior muscular part of this organ reaches from the 13th to the end of the 14th segment.

* Michaelsen, "Die Oligochaeten Nordost-Afrikas," Zool. Jahrb. xviii. (1903), p. 493, Taf. xxv. fig. 23: see also *id.*, "Die Oligochaeten Deutsch-Ostafrikas," Zeitsch. wiss. Zool. lxxxii. (1905), p. 301, fig.

† Smith and Green, "Descriptions of new African Earthworms &c.," Proc. U.S. Nat. Mus. lv. (1919), p. 163.

The softer narrower region of the sac following this lies for a certain portion of its length in a straight line coextensive with the clitellum—*i. e.*, occupying segments 15, 16. This part is enclosed in a cœlomic sac and ends at septum 16/17, which is in contact with the front wall of the large bursa copulatrix. A further region of the spermathecal sac turns abruptly upwards and lies dorsally. I do not see any difference in structure here, except in the fact that, as already mentioned, it ends in a slight dilatation.

Anteriorly the cœlomic sac, which involves loosely the tubular region of the spermathecal sac, and therefore encloses a considerable hollow space in addition to that sac, appears to be continuous with the muscular sacs already described as lying upon the muscular mid region of the spermathecal sac. It connects them together and to the walls of segment 13; the wall of this part of the cœlomic sac is, however, more closely attached to the surface of the muscular section of the spermathecal sac. There is but a narrow cavity within it. I am disposed to believe—but I cannot absolutely prove the matter—that the peri-spermathecal cœlomic sac is continuous with the sac lying between the two sheets of muscle on each side, which extend over the muscular region of the spermathecal sac in the way that has been described. As in specimen B, already described, the spermathecal sac ends in front in a rather flattened strap-shaped region bending down at right angles, or nearly so, to the median muscular part to approach the median line of the body-wall. An actual external orifice, if present, is hardly visible, and it is quite possible that it is plugged, as is the case for example with species of *Eudriloides*—*e. g.*, *E. cotterilli*, as figured by myself*.

Neither in "A" nor "C" could I find the crescent-shaped pore so obvious in "B." Futhermore, it is plain from this longitudinal section of the worm that the spermathecal pore is not retracted with the external orifices of the "Nebentaschen." Nor could they very well be retracted, I should imagine, from a consideration of the structure of these parts.

This fact of itself is a difference from the other species of the genus, *Notykus emini*, in which Michaelsen distinctly states that the spermathecal pore itself can be retracted together with the orifices of the "Nebentaschen." This could hardly be possible in the present species, and for the

* "A Contribution to our Knowledge of the Oligochaeta of Tropical Eastern Africa," *Quart. J. Micr. Sci.* xxxvi. (n. s.), pl. xvii. fig. 16.

following reasons:—The external orifices of the “Nebentaschen” in the bisected specimen now under consideration are considerably retracted, as I have explained; but the distance between their openings and the line along which the spermathecal pore touches the body-wall, which is very plain, is considerable. For, while the spermathecal pore is clearly upon segment 13, the pores of the muscular appendices are not only in the 14th segment, but some little way within it. A great area would have to be pulled inside the body-cavity if the spermathecal pores were to be withdrawn. Furthermore, the strap-like external region of the spermathecal sac is tightly tied to the slender wall forming the septum 12/13, which together with the spermathecal sac itself forms a closed cavity within which lies the peculiar accessory gland, referred to above, and—as I believe, though I have not clearly seen them—the ovaries and the funnel of the oviduct. All this complex would have to be pulled inwards if the spermathecal pore were retracted, and it does not seem possible. In any case, the spermathecal pore was *not* retracted in this specimen.

The muscular double-walled bands lying across the spermathecal sac, which have been described, lie, it should be added, in an oblique direction from before backwards; it is possible that they represent septum 14/15, which is otherwise not recognisable. Nor, for the matter of that, is the next septum—*i. e.*, 15/16.

In the angle which lies between the muscular gizzard-like region of the spermathecal sac and the anterior downwardly directed external passage of the same lies a triangular-shaped muscular sac, which is clearly the “Nebentasche” of its side. It is not so uniformly rounded as in the less mature example B; but ends above in quite a pointed end. It lies over the gizzard-like region and is marked off by a deep furrow from the strap-shaped end of the spermathecal sac, and by a less marked, but still quite marked, furrow from a muscular layer lying across the gizzard-shaped median region of the spermathecal sac.

The two masses of muscle, thus brought into intimate connection with the spermathecal sac, must presumably, when contracting, tend to compress the sac and to squeeze out its contents. If this sac, as in the allied genus *Stuhlmannia*, contains a spermatophore, this might conceivably be expelled by the contractions. But of such functions we know nothing in these and allied worms.

Nothing at all corresponding to the posterior double sheet

of muscle occurring in *Notykus kilossensis* is mentioned by Michaelsen in *Notykus emini*.

It will be plain from the above account of the spermathecal sac in the two mature examples of my new species, A and C, that there are differences between them which are probably to be put down to greater maturity in the specimen A than in C. The muscular bags lying over the posterior region of the spermathecal sac in A are much thicker than the thin sheet which is described above in the bisected individual C. Their lumen also appears to be continuous with that of the "Nebentaschen," with which, indeed, they seem to be quite continuous structures—a backward extension, that is to say, of the "Nebentaschen." The conditions observable in specimen C may indicate that the actual origin of the "Nebentaschen" and the posterior sacs of the spermathecal sac are distinct. But I have not ascertained whether the undoubtedly more delicate muscular layer of the posterior region of the spermathecal sac in C is actually double, and, therefore, contains a lumen. Intermediate stages appear to me to be wanting—the two do not constitute a chain without a break.

LXIV.—*On some new Mammals from Korea and Manchuria.*

By Prof. T. MORI, Keijo High School, Seoul, Korea.

IN the course of some studies of Korean and Manchurian mammals, undertaken in the British Museum (Natural History), by the kind permission of Sir Sidney F. Harmer and Mr. Oldfield Thomas, I have found the following hitherto unnamed mammals. The types of these have been presented to the British Museum.

Nyctereutes koreensis, sp. n.

Nyctereutes procyonoides, Gray, Thomas, P. Z. S. 1907, p. 464.

Type.—Adult male (skin and skull). Original number 2. Collected at Giseifu, near Seoul, Korea, January 24th, 1922, by Mr. Eizo Takahashi. B.M. no. 22. 10. 6. 6.

Diagnosis.—Size less than that of *Nyctereutes ussuriensis*, Matschie, and *N. amurensis*, Matschie, of the Amur region. Cheek darker, forehead and part under the ear whiter than in